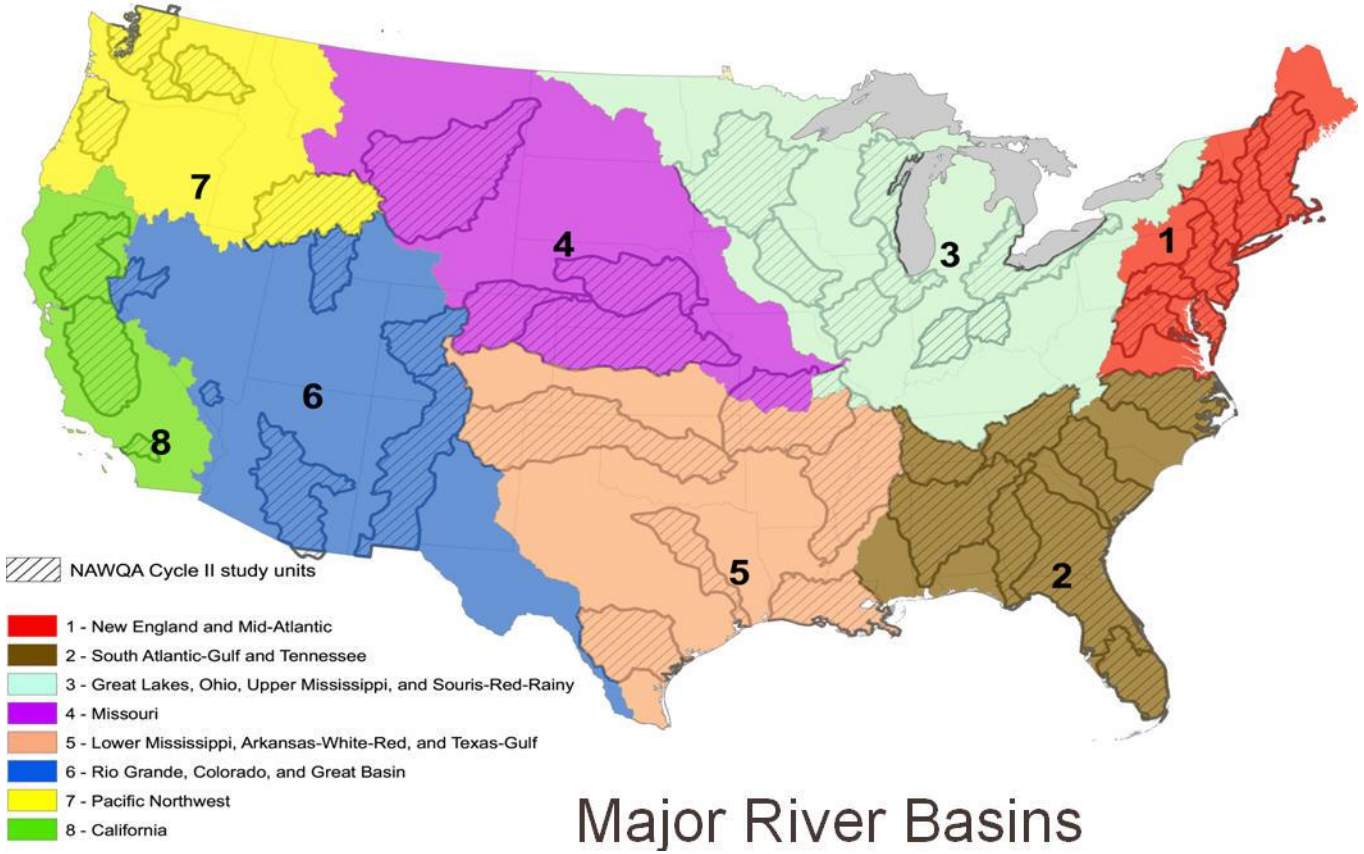
Regional Assessments of Nutrient Sources, Transport, and Delivery to Streams and Coastal Areas

Mike Woodside
USGS National Water-Quality Assessment Program

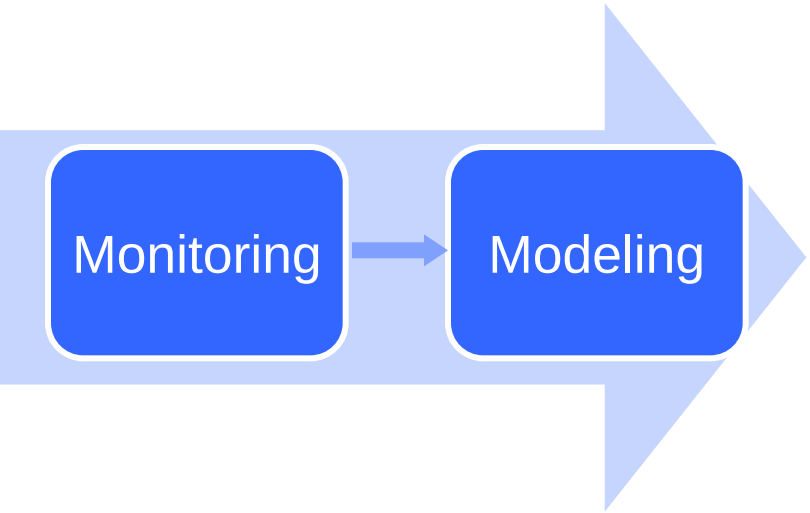


Major River Basins

USGS

Regional assessments of nutrient sources and transport

Objective: **Build understanding of how human activities and natural features influence nutrient conditions in streams**



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Approach

Integrate monitoring data and watershed data within a regional model framework

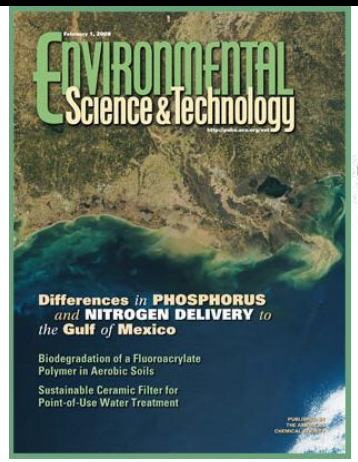
Integrate USGS data with data from other Federal and state agencies

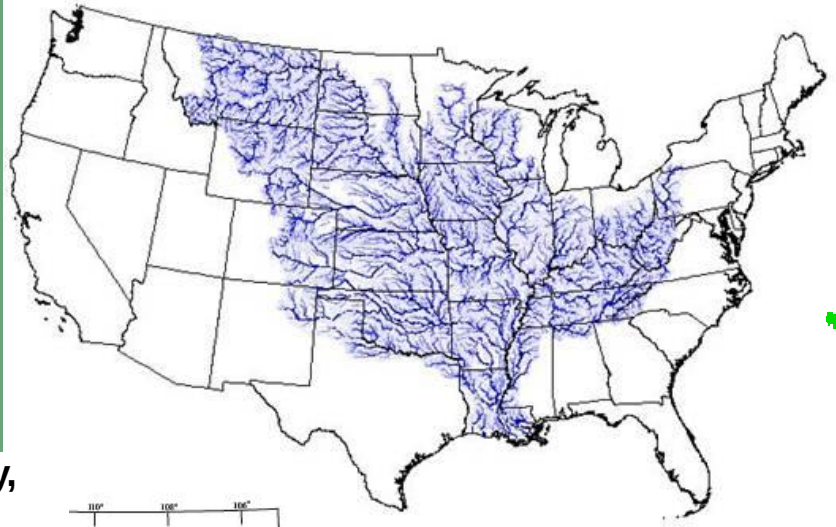
Presentation Outline

- **SPARROW model concepts**
- **Preliminary model estimates of total nitrogen concentrations and yields for the southeastern U.S. for 2002**
- **Preliminary model estimates of total nitrogen yields for the Santee River Basin and Coastal Drainages for 2002**

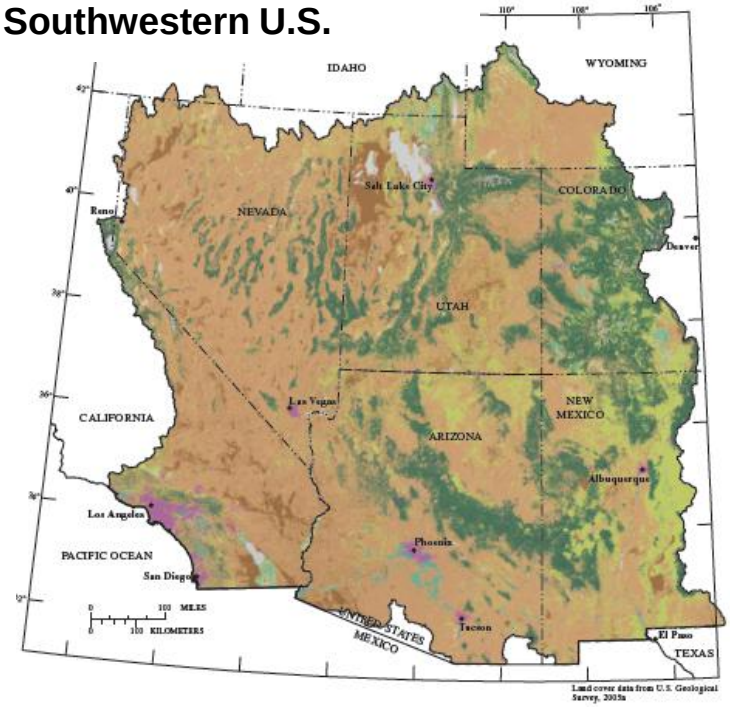
USGS

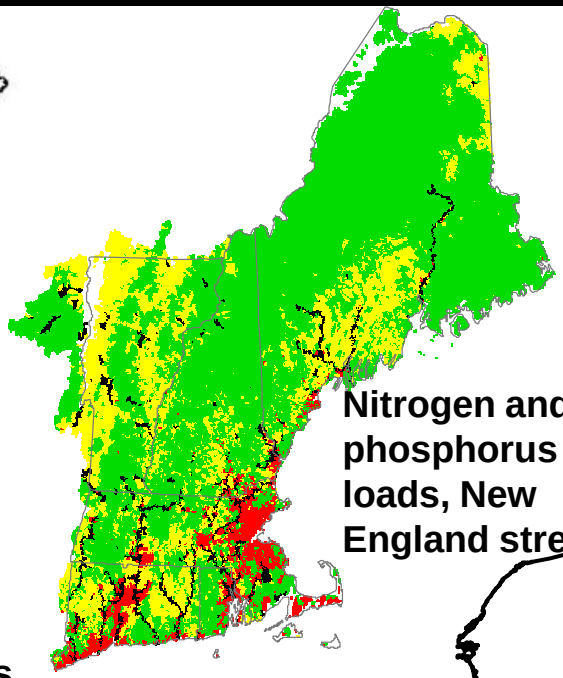
National and regional-scale SPARROW models





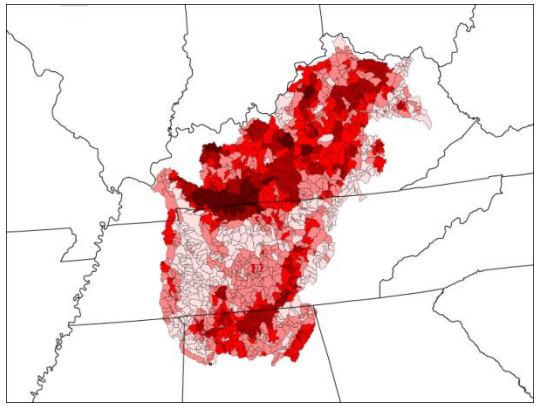
Source areas of salinity, Southwestern U.S.



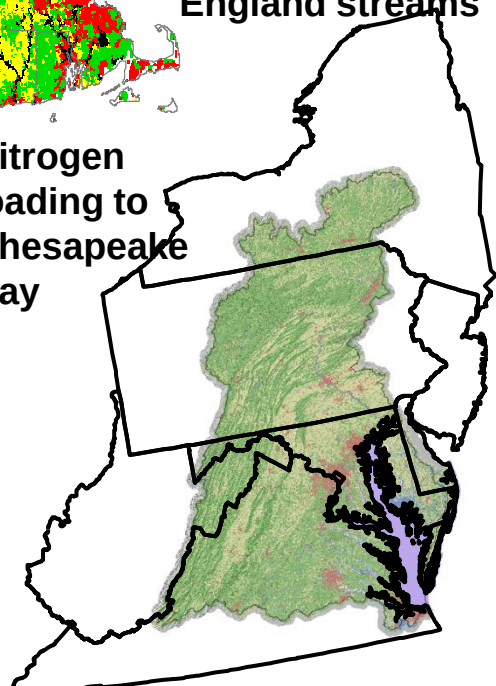


Nitrogen and phosphorus loads, New England streams

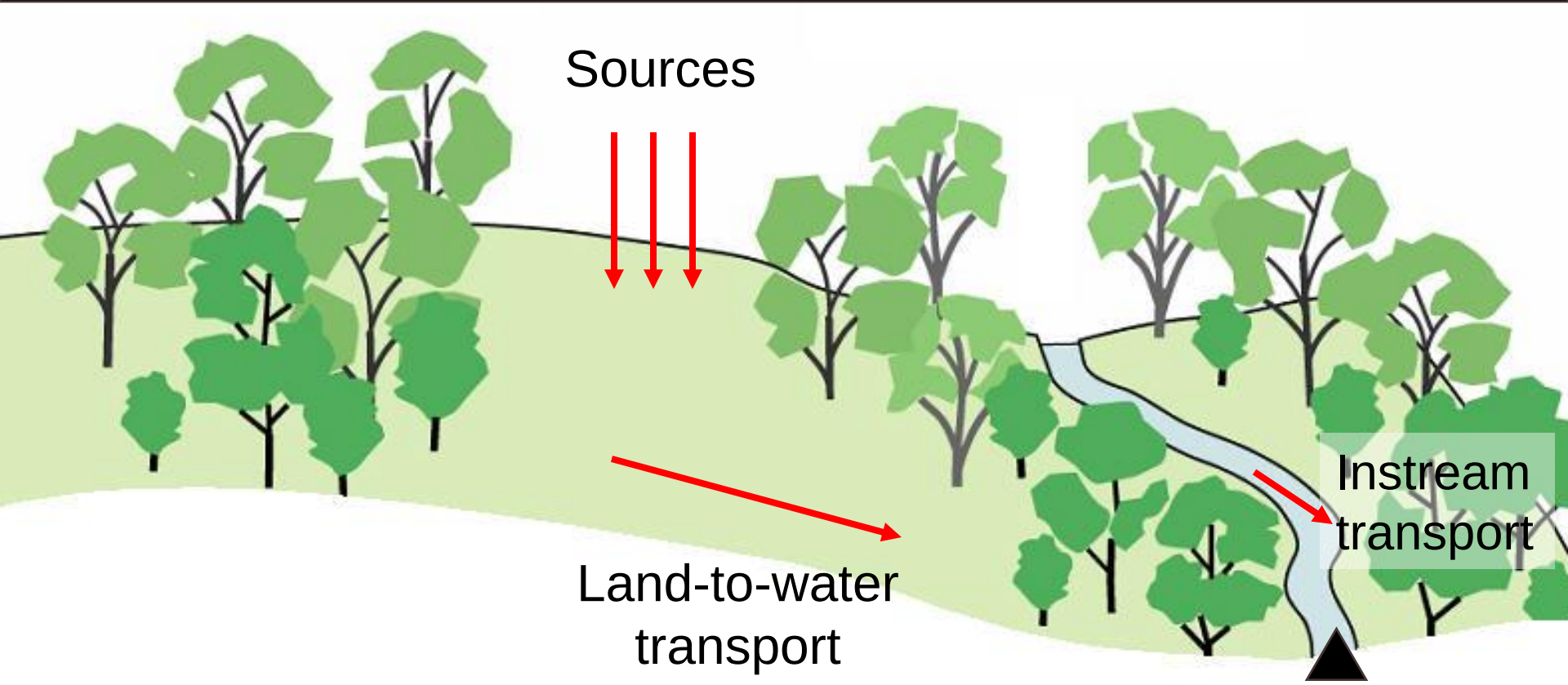
Nitrogen and phosphorus loads, Interior Low Plateau



Nitrogen loading to Chesapeake Bay



SPARROW* Model Concept



***SPA**tially **R**eferenced **R**egression **O**n **W**atershed Attributes**

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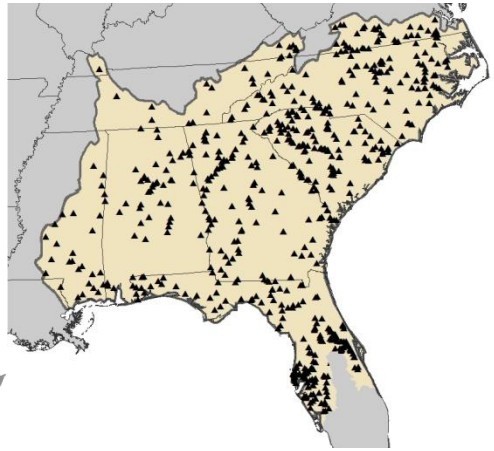
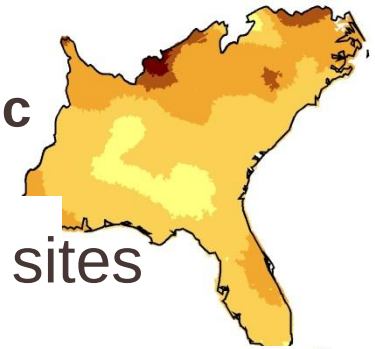
SPARROW Model Framework

Monitoring Data
782 Sites



Spatial Data Layers

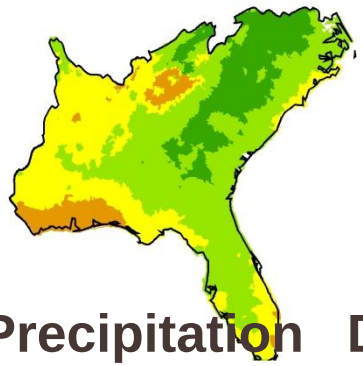
Atmospheric deposition



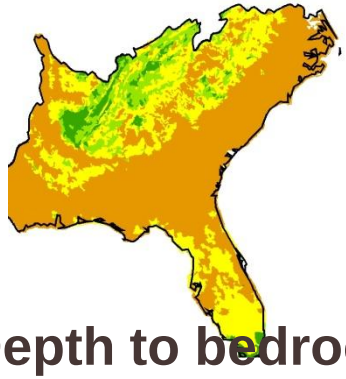
NADP – 33 sites

Fertilizer applied to farmland

2002 County Est.



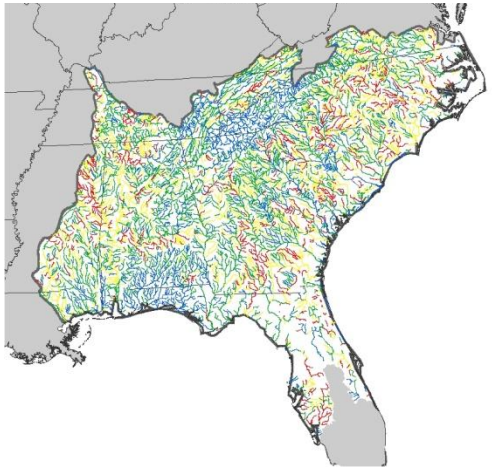
Precipitation



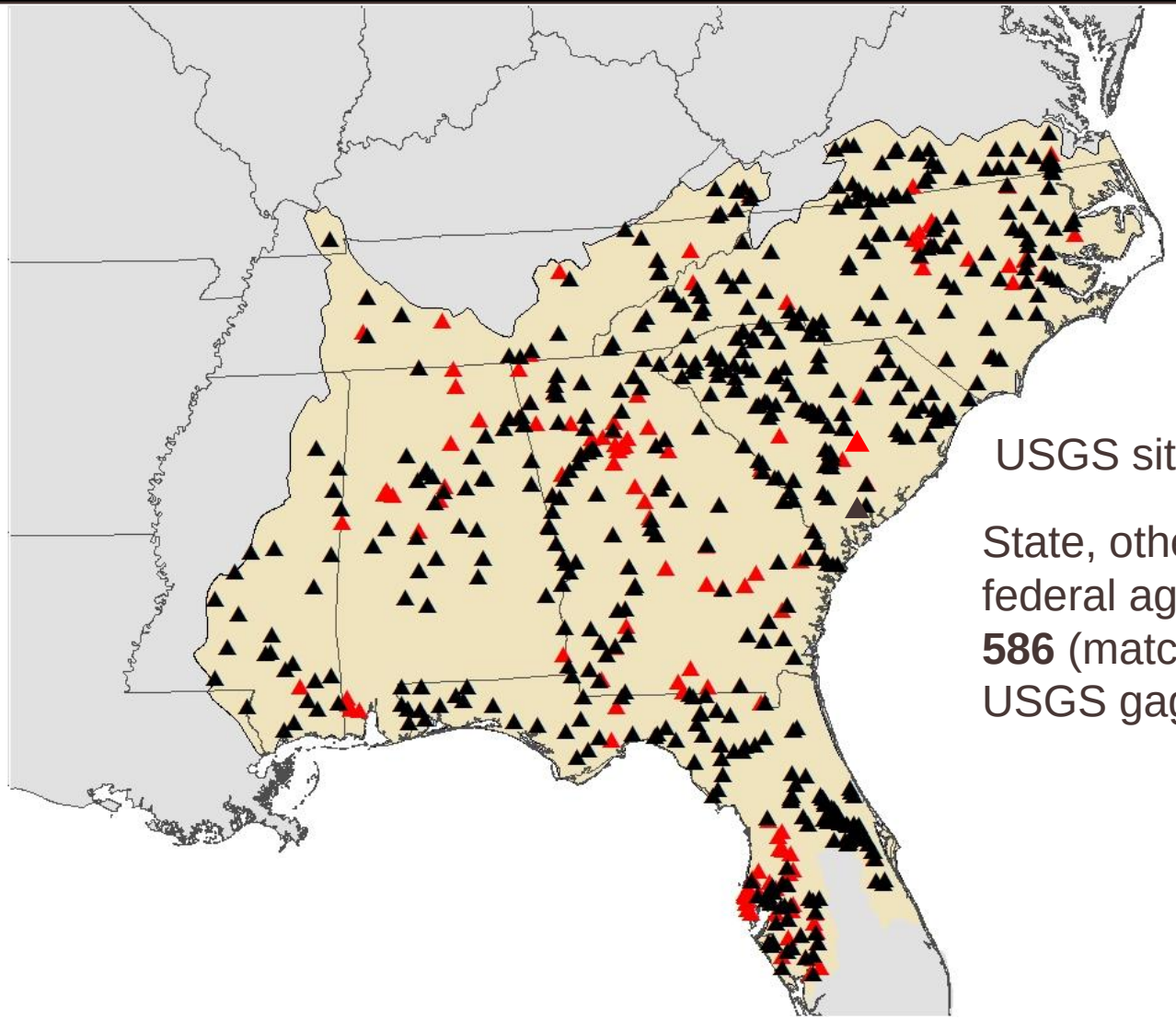
Depth to bedrock

STATSGO

Model Predictions
8,092 Stream Reaches



Estimates of mean annual nutrient load at 782 sites for 2002



USGS sites: **196**

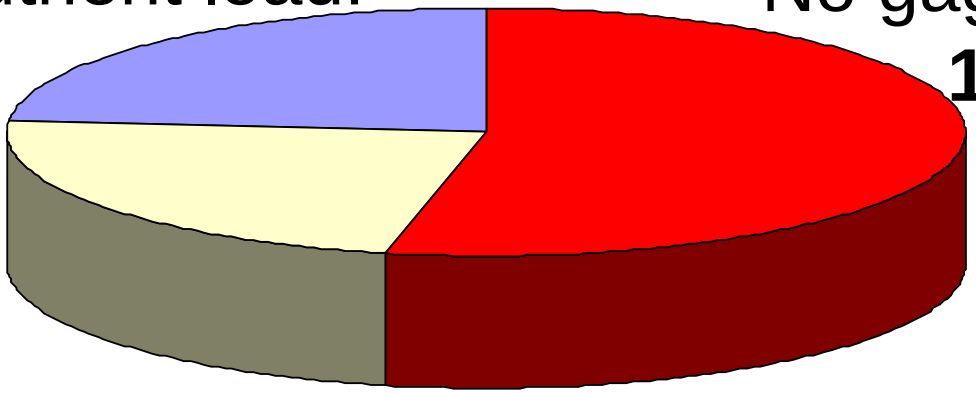
State, other federal agencies: **586** (matched to USGS gage)

USGS

“Shakedown” of monitoring data for load estimation

- Nutrient data retained for 21,500 stream sites
- 3,400 sites with sufficient record (Quarterly with minimum of 20 samples)

Estimate nutrient load: **782** sites

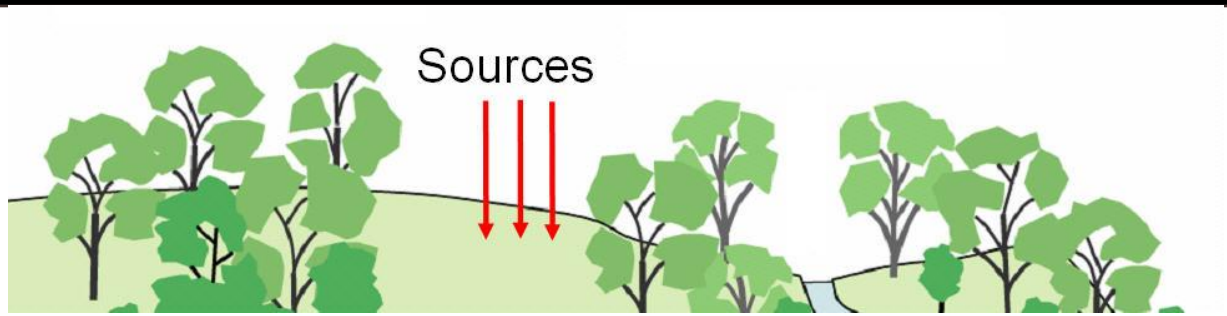


No gage nearby: **1824** sites

Insufficient streamflow record: **794** sites

USGS

Sources accounting for instream nitrogen load



% contribution to instream load, average for region

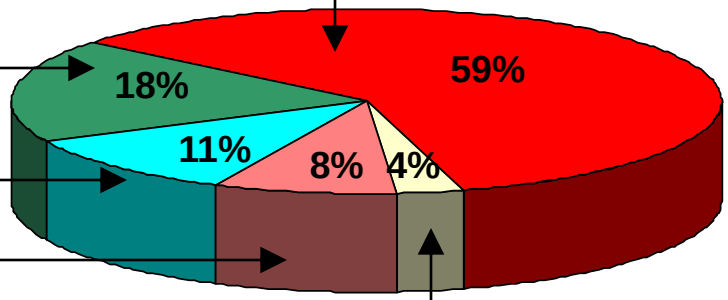
Atmospheric deposition

Fertilizer applied to farmland

Animal waste

Impervious surface area

Point-source discharge



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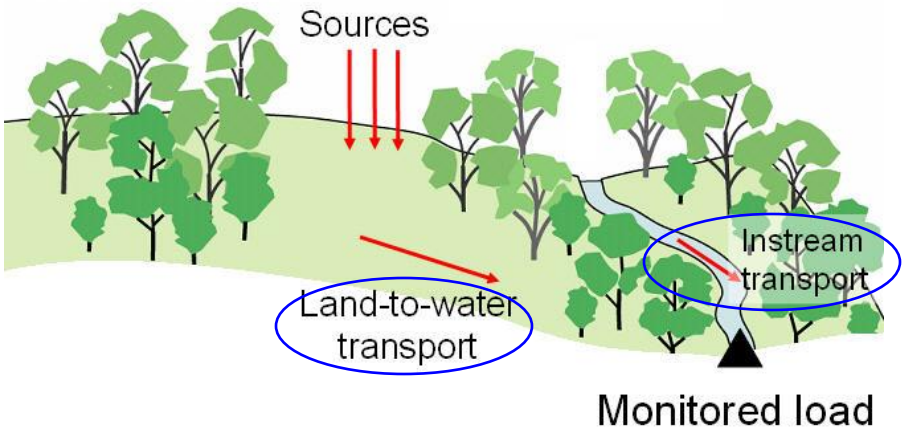
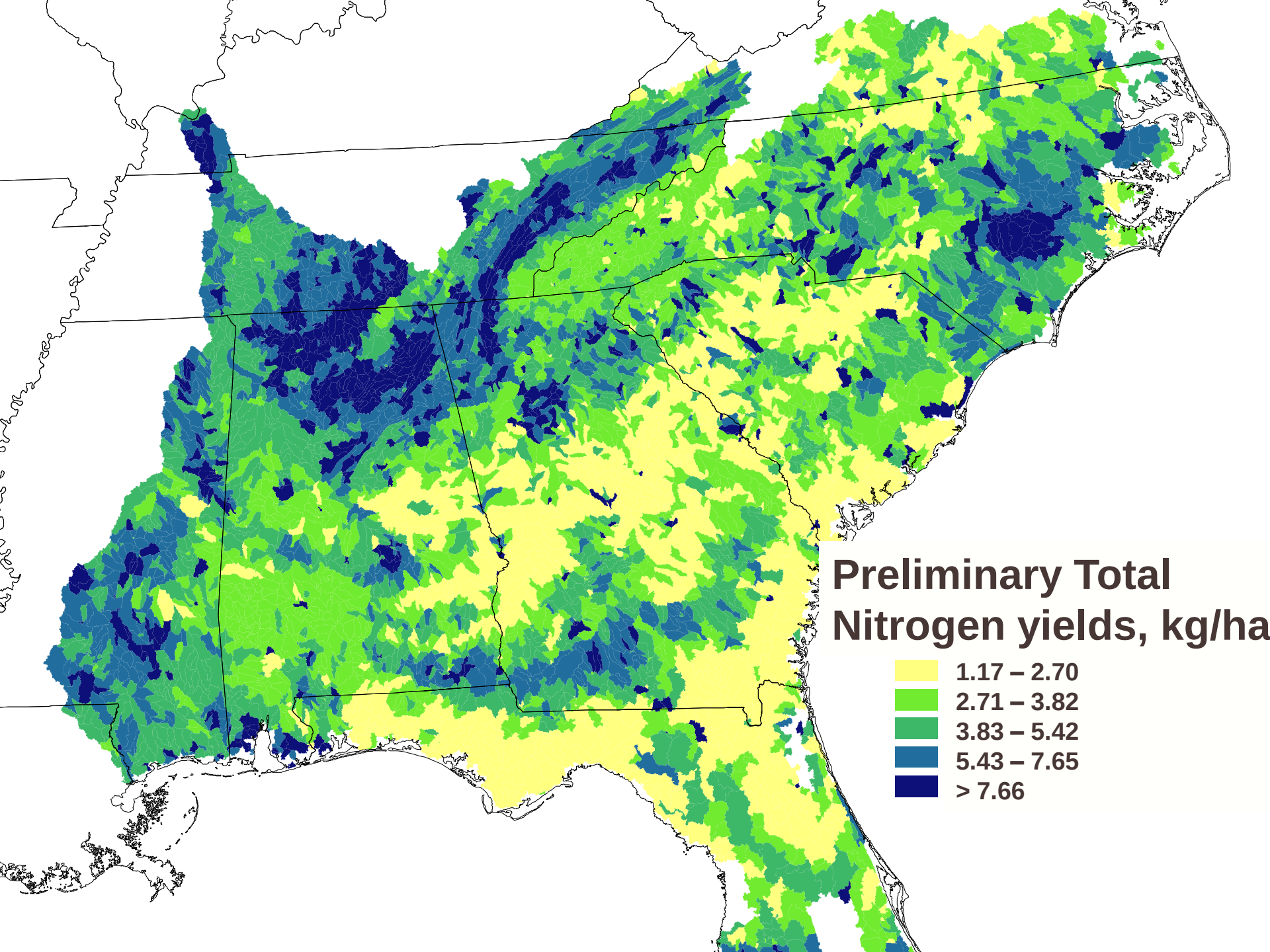
Factors controlling transport of nitrogen

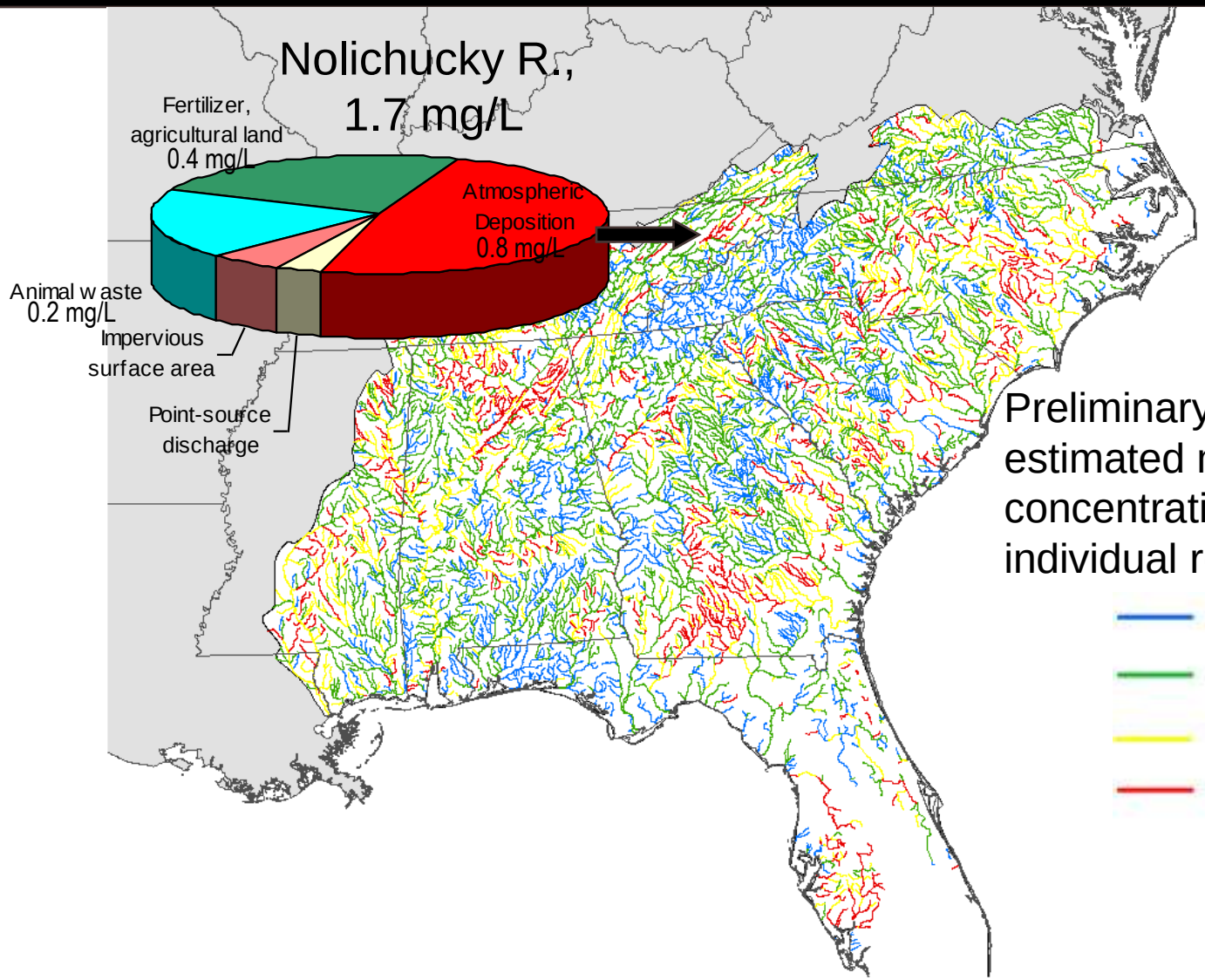


Land to water transport	Instream transport
Soil permeability	Instream time of travel
Depth to bedrock	Reservoir residence time
Annual precipitation	

USGS


Preliminary Total
Nitrogen yields, kg/ha
1.17 – 2.70
2.71 – 3.82
3.83 – 5.42
5.43 – 7.65
> 7.66

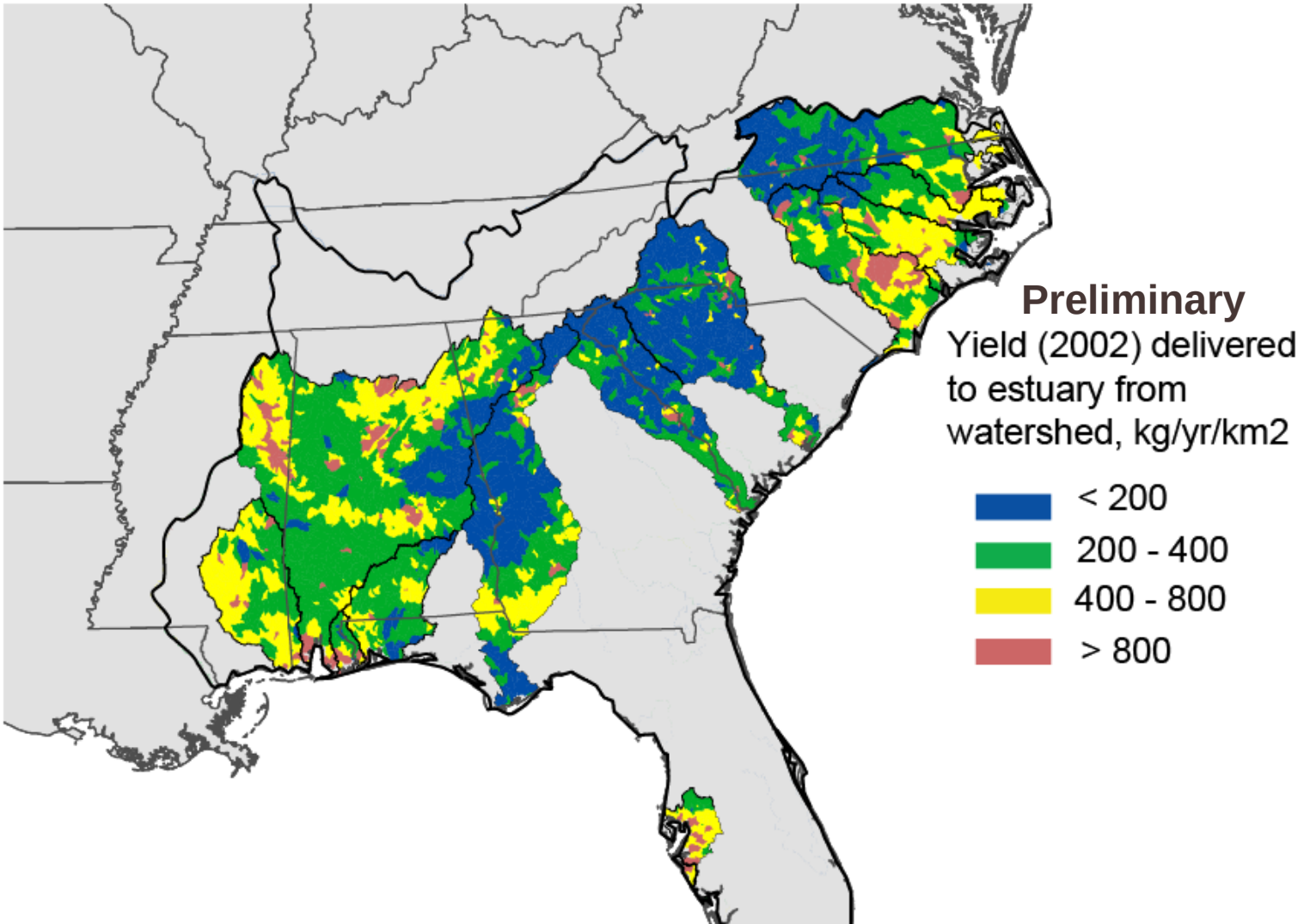
SPARROW model results support resource management decisions



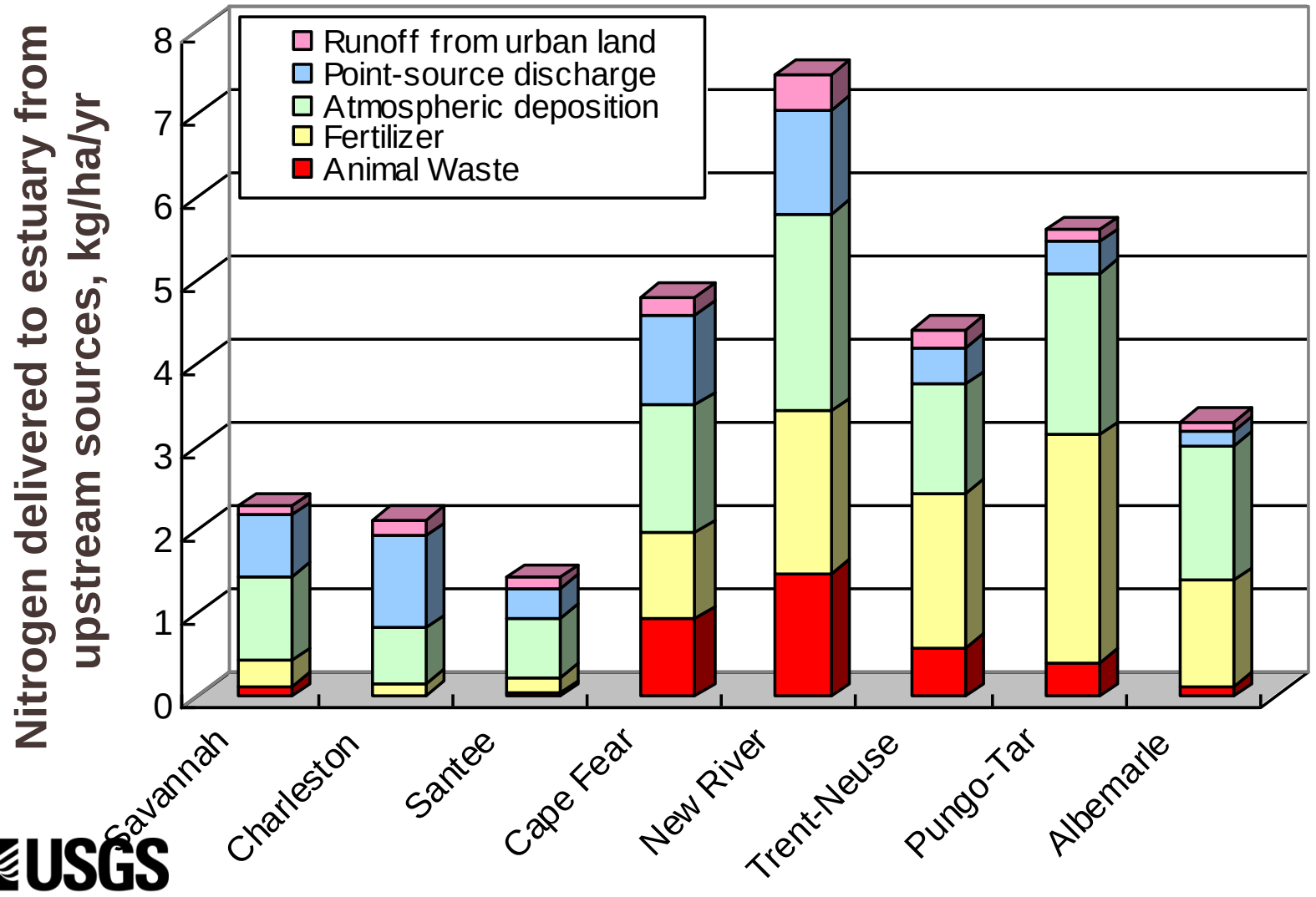
Preliminary model – 2002 estimated mean annual concentration for individual reaches, in mg/L

- < 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

Model results indicate areas contributing greatest amounts of nitrogen to estuary



Preliminary yield and source shares of total nitrogen delivered to South Atlantic Estuaries



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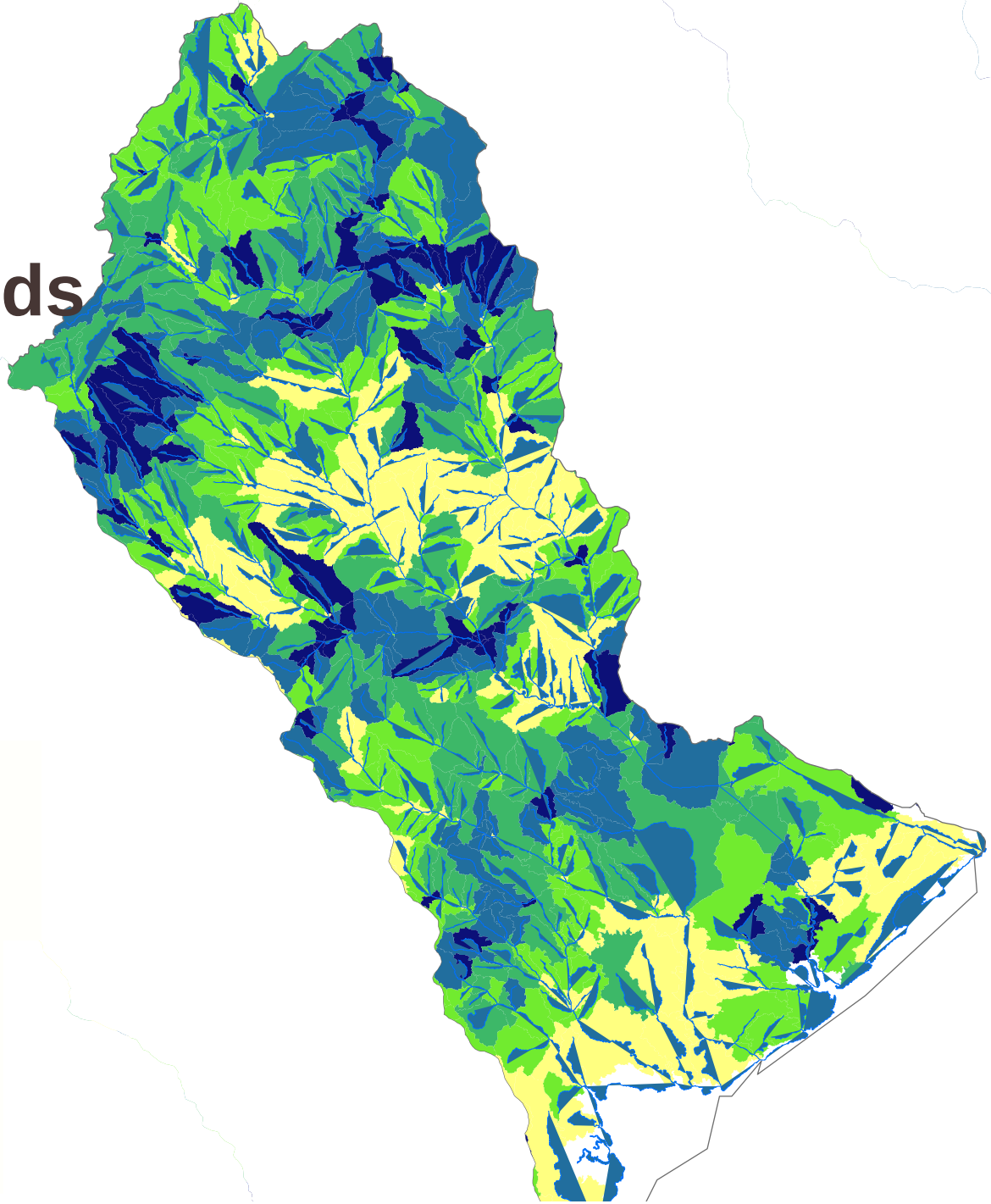
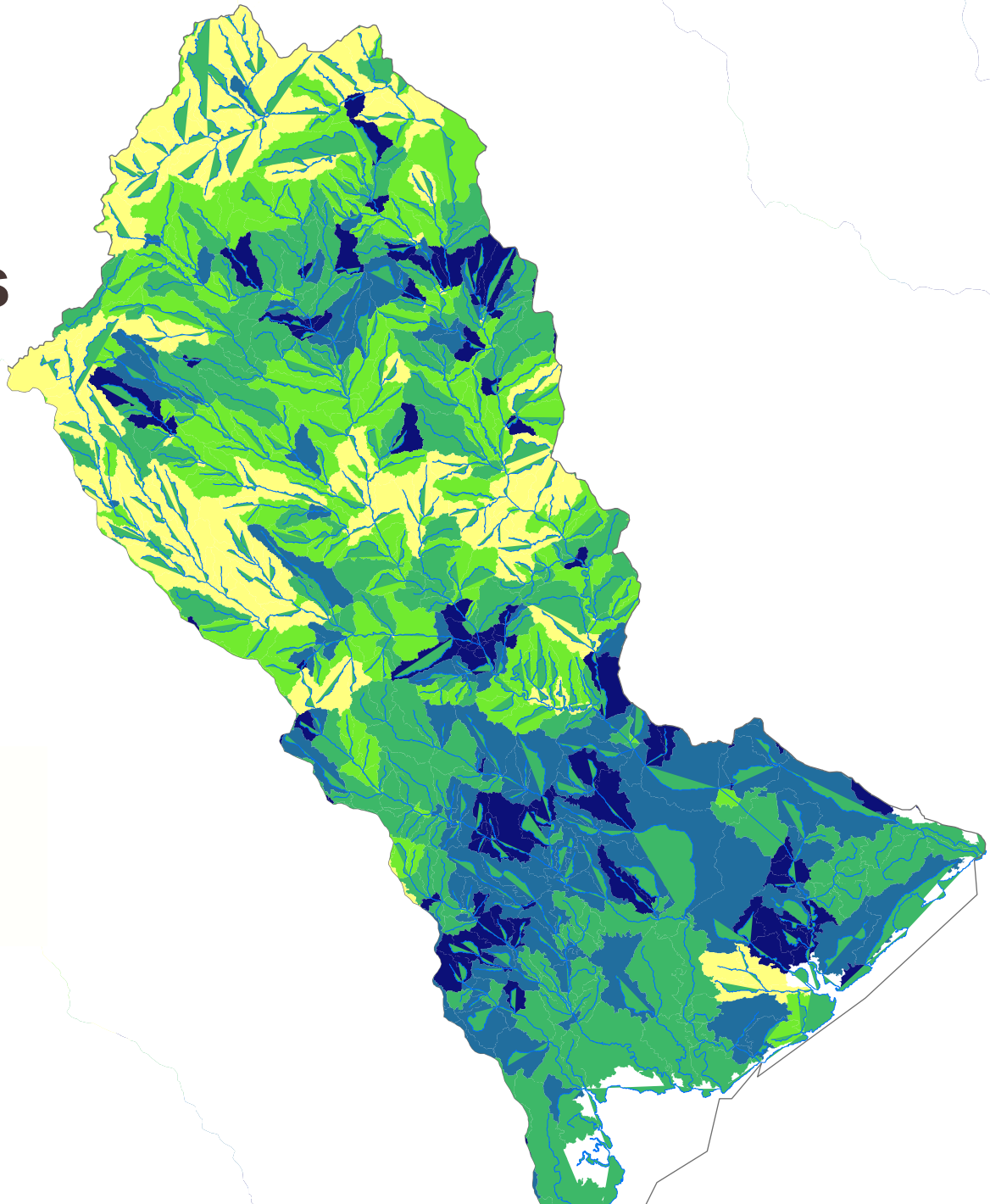
Santee River Basin and Coastal Drainages—
Incremental Yields



Preliminary Total Nitrogen Yields, in kg/ha

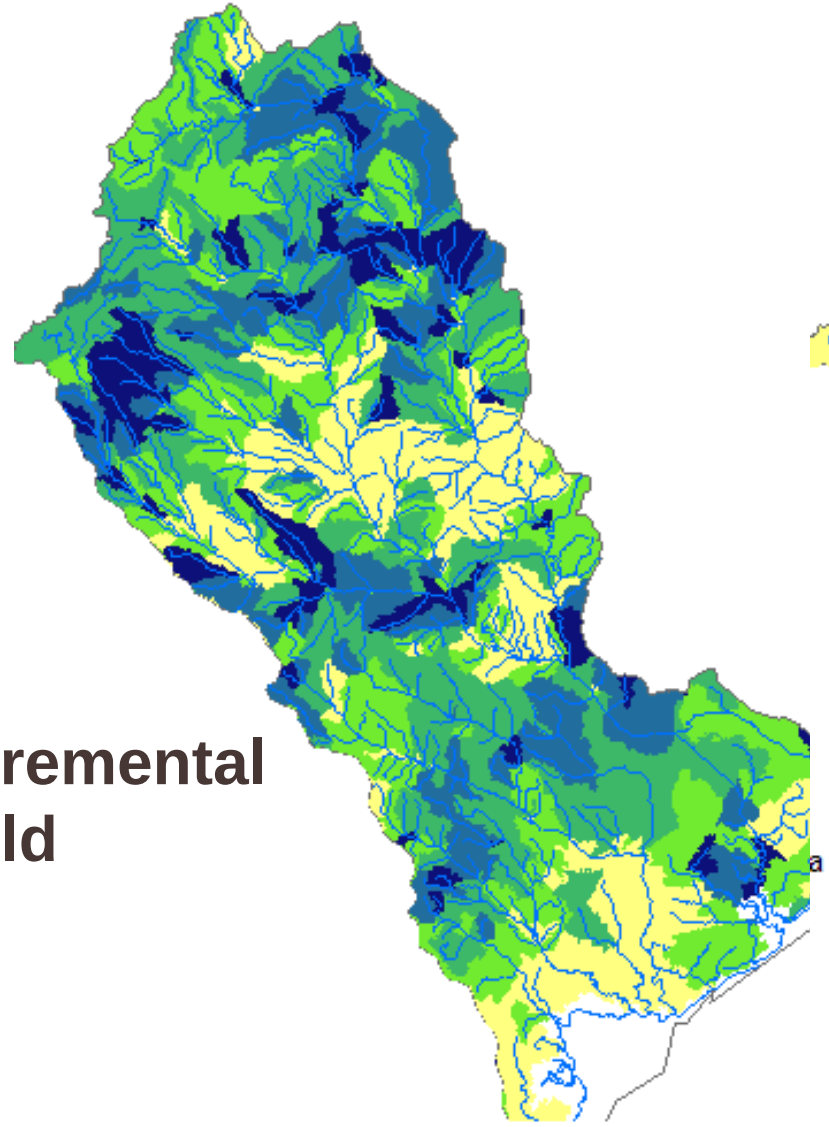
- 1.32 – 2.30
- 2.31 – 2.88
- 2.89 – 3.86
- 3.87 – 5.19
- > 5.20

Santee River Basin and Coastal Drainages—
Delivered Yields



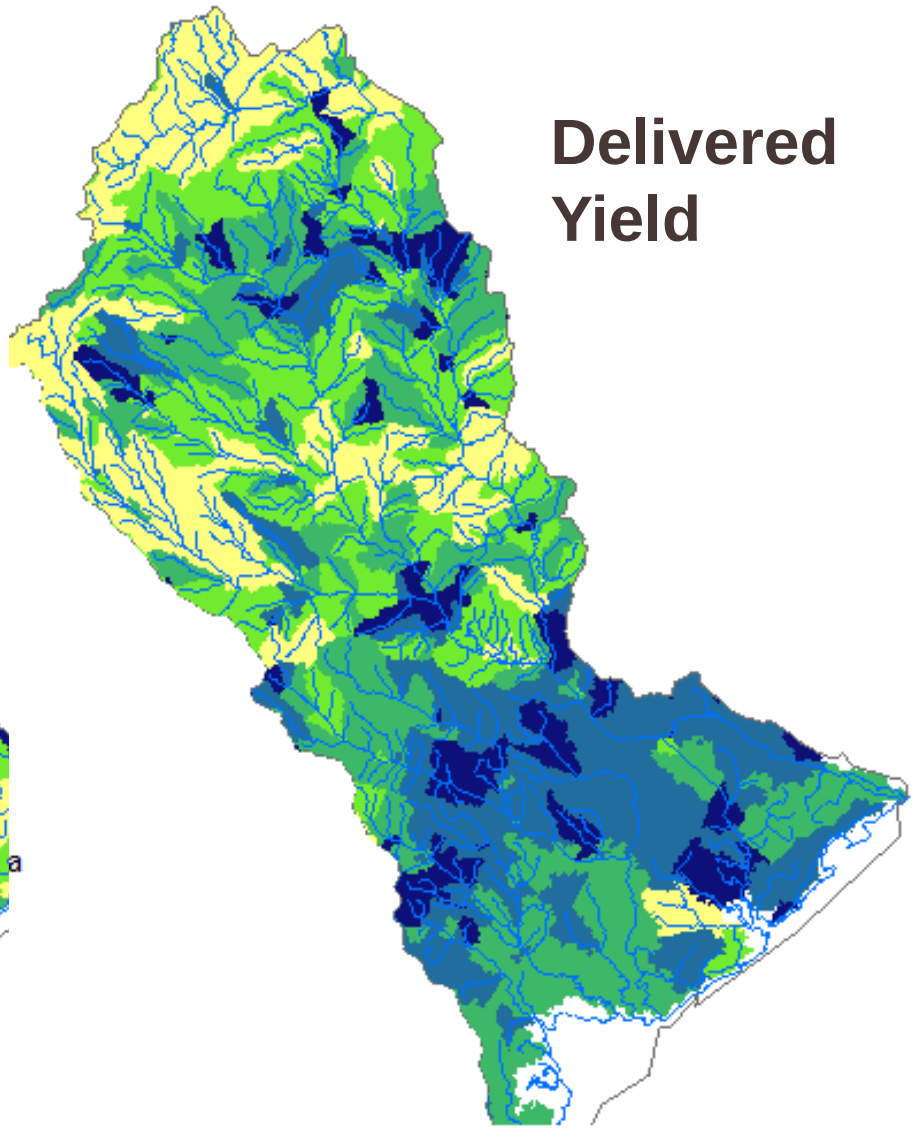
Preliminary Total Nitrogen Yields, in kg/ha

- 0.31 – 1.08
- 1.09 – 1.53
- 1.54 – 2.18
- 2.19 – 2.97
- > 2.98



Incremental Yield

1.32 – 2.30
2.31 – 2.88
2.89 – 3.86
3.87 – 5.19
> 5.20



Delivered Yield

0.31 – 1.08
1.09 – 1.53
1.54 – 2.18
2.19 – 2.97
> 2.98

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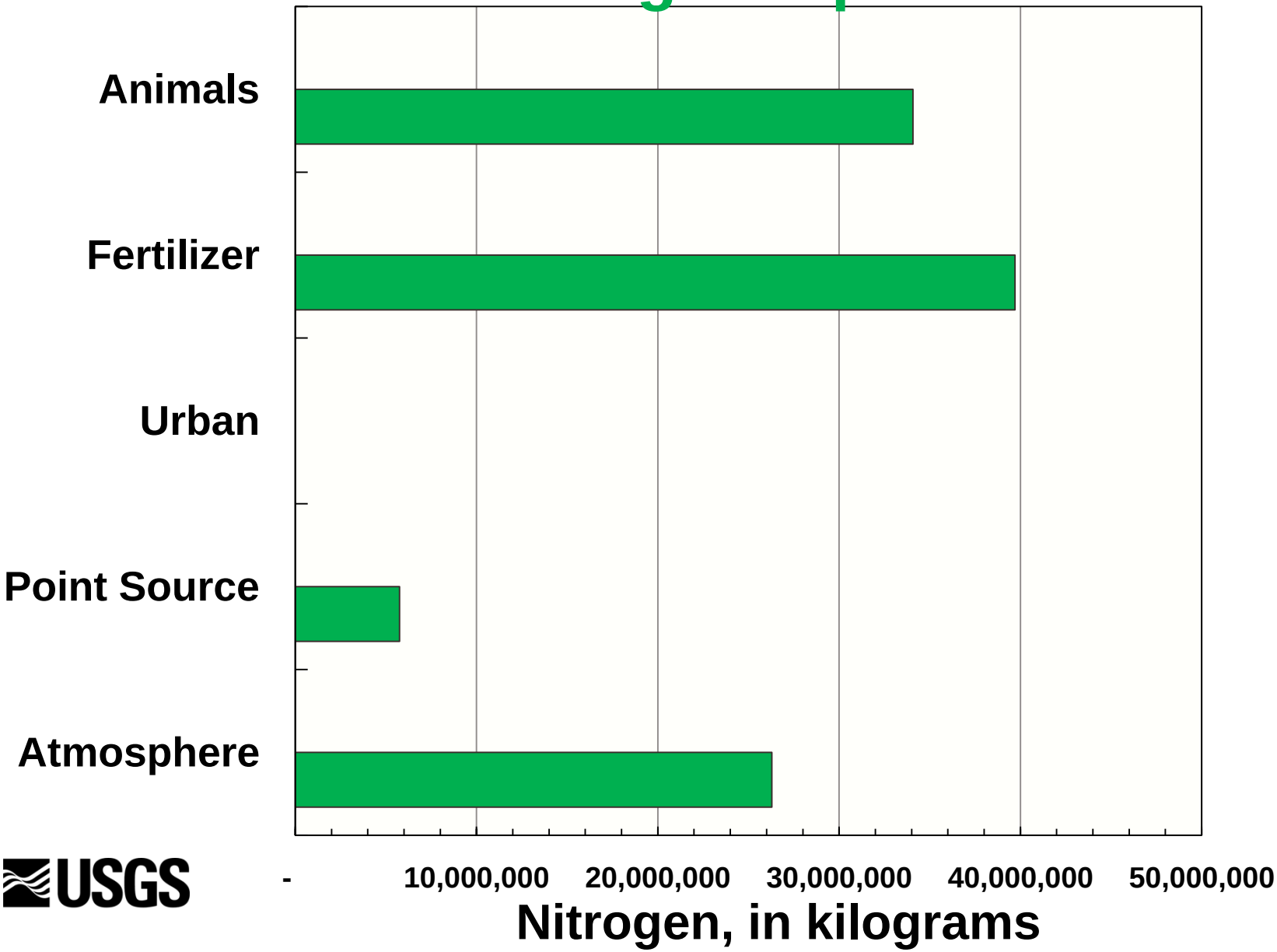
Total Nitrogen Inputs



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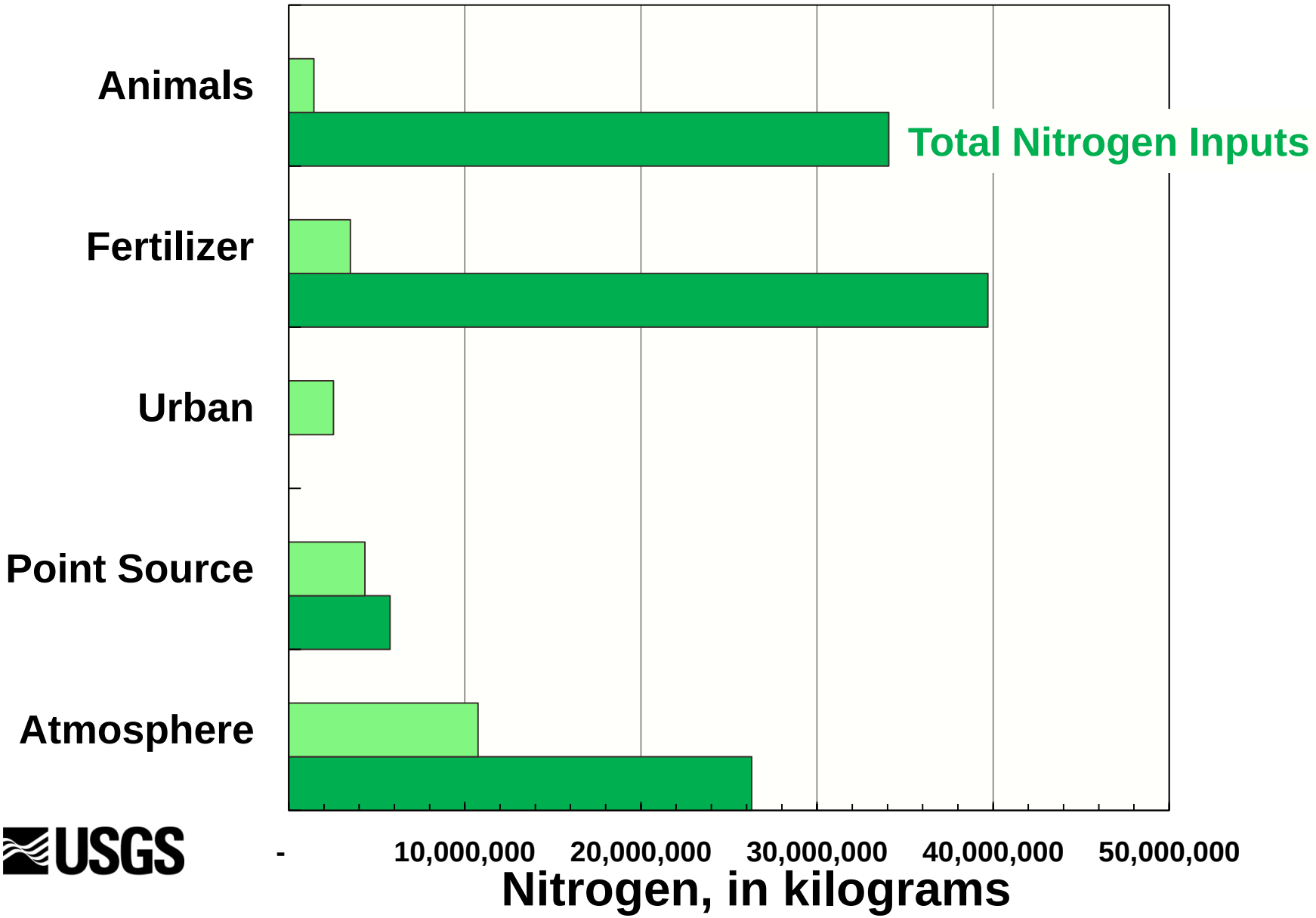
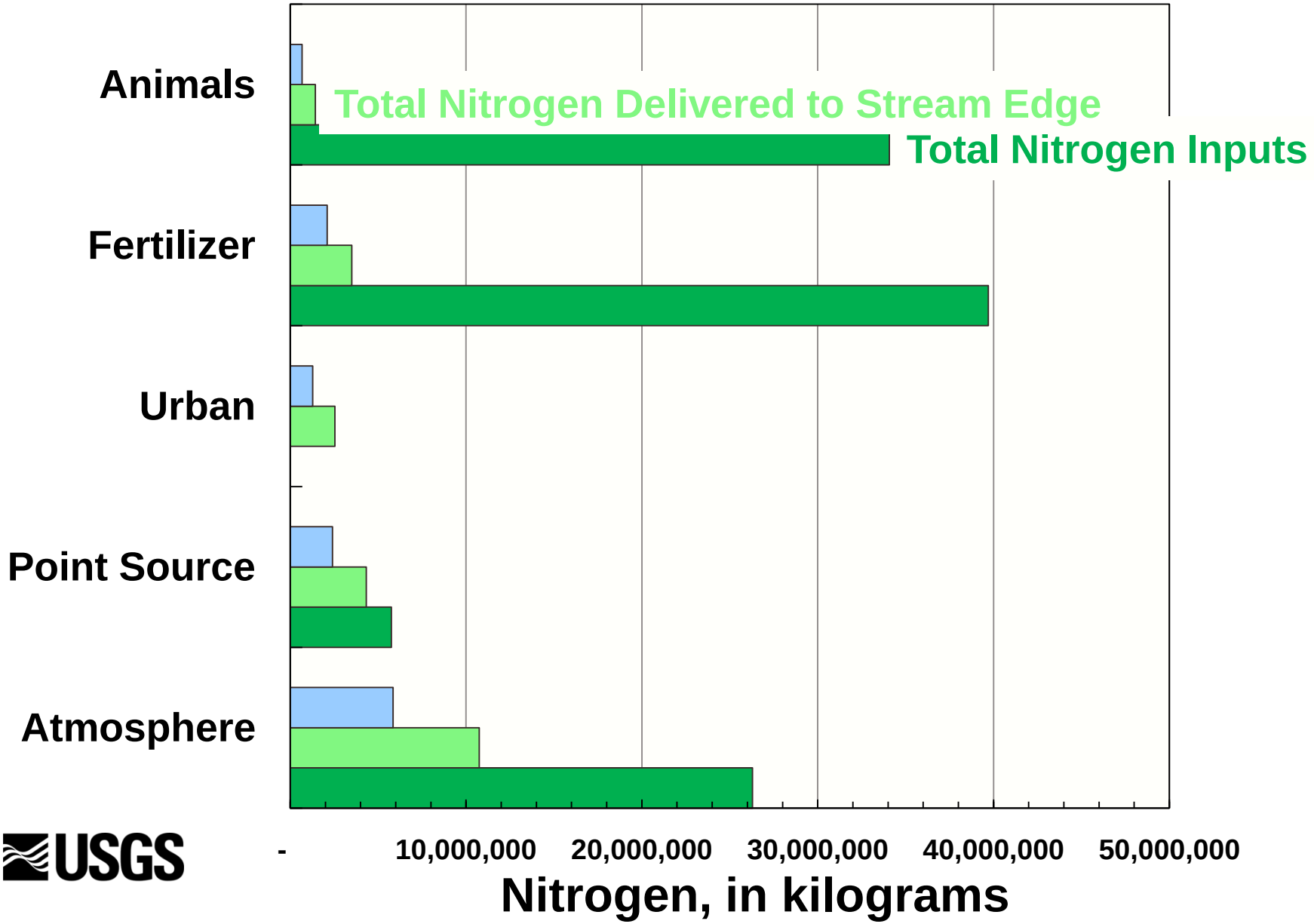
Total Nitrogen Delivered to Stream Edge



USGS

Total Nitrogen Transported to Estuary



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Contact Information

http://pubs.usgs.gov/of/2008/1163/
http://pubs.usgs.gov/of/2007/1040/

Mike Woodside
NAWQA Regional Coordinator
mdwoodsi@usgs.gov

Anne Hoos
TN Water Science Center
abhoos@usgs.gov

Ana Garcia
NC Water Science Center
agarcia@usgs.gov

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http://water.usgs.gov/nawqa/sparrow/